

## Claims

1. An optical microcantilever employed in a scanning near field microscope, comprising:

5 an optical waveguide, having a light input/output end and a free end, for propagating light;

a tip formed at the free end, with a microscopic aperture at an end thereof; and

10 reflecting means for reflecting light propagated from the light input/output end in such a manner that the light is guided towards the microscopic aperture, or reflecting light propagated from the microscopic aperture towards the light input/output end.

2. An optical microcantilever employed in a scanning near field microscope, comprising:

15 an optical waveguide, having a light input/output end and a free end and a nose portion at an angle with respect to an optical axis of propagating light passing through the light input/output end, for propagating light;

a tip formed at the free end, with a microscopic aperture at an end thereof; and

20 reflecting means for reflecting light propagated from the light input/output end in such a manner that the light is guided towards the microscopic aperture, or reflecting light propagated from the microscopic aperture towards the light input/output end.

3. The optical microcantilever of any one of claims 1, 2, 11 and 12, wherein at  
25 least part of the optical waveguide comprises a core, and cladding deposited on one side of the core, or both sides of the core, or deposited so as to surround

the core.

4. The optical microcantilever of any one of claims 1 to 3, 11 and 12, wherein a light-blocking film is provided on the optical waveguide at the side where the tip is formed, and a reflecting film is provided at the opposite side to the side where the tip is formed.

5. A method for manufacturing an optical microcantilever employed in a scanning near field microscope, comprising steps of:

forming a step to be taken as a mold for an optical waveguide at the substrate;

10 depositing a reflecting film on the substrate;

depositing an optical waveguide on the reflecting film;

forming a tip by working the optical waveguide;

depositing a light-blocking film on the optical waveguide;

forming a microscopic aperture at the end of the tip; and

15 forming a supporting section by having the substrate remain on the side to be a light input/output end and removing the substrate on the side to be the free end.

6. The method for manufacturing the optical microcantilever of claim 5, wherein an angle of the step formed in the step forming step is an angle enabling propagating light propagating from the light input/output end to be guided towards the microscopic aperture by the reflecting film deposited in the reflecting film depositing step, or is an angle enabling propagating light propagating from the microscopic aperture to be guided towards the light input/output end.

25 7. An optical microcantilever employed in a scanning near field microscope, comprising:

a cantilever constituted by an optical waveguide;

a supporting section for the cantilever;

the optical waveguide having a light input/output end and a free end;

an optical element guide formed at the supporting section for deciding a  
 5 position of an optical element acting on light entering the optical waveguide or  
 on light exiting from the optical waveguide; and

a channel provided between the light input/output end and the optical element  
 guide.

8. A method for manufacturing an optical microcantilever employed in a  
 10 scanning near field microscope, comprising steps of:

forming a step to be taken as a mold for an optical waveguide at the  
 substrate;

forming an optical element guide at the substrate;

depositing an optical waveguide on the substrate;

15 forming a light input/output end of the optical waveguide;

forming a channel by working the substrate between the light input/output end  
 and the optical element guide;

exposing the optical element guide by removing the optical waveguide on the  
 optical element guide; and

20 forming a supporting section by having the substrate remain on the side to be  
 a light input/output end and removing the substrate on the side to be the free  
 end.

9. A method for manufacturing an optical microcantilever employed in a  
 scanning near field microscope, comprising steps of:

25 forming a step to be taken as a mold for an optical waveguide at the  
 substrate;

forming an optical element guide for fixing a position of an optical element acting on light entering the optical waveguide or on light exiting from the optical waveguide at the substrate;

depositing a reflecting film on the substrate;

5 depositing an optical waveguide on the reflecting film;

forming a tip by working the optical waveguide;

depositing a light-blocking film on the optical waveguide;

forming a microscopic aperture at the end of the tip;

10 forming a light input/output end of the optical waveguide by removing the light-blocking film, the optical waveguide, and the reflecting film, for the portion to constitute the light input/output end of the optical waveguide;

forming a channel by working the substrate between the light input/output end and the optical element guide;

15 exposing the optical element guide by removing the light-blocking film, the optical waveguide, and the reflecting film on the optical element guide; and

forming a supporting section by having the substrate remain on the side to be a light input/output end and removing the substrate on the side to be the free end.

20 10. An optical microcantilever holder comprising: an optical microcantilever guide for supporting an optical microcantilever; and

an optical element guide for deciding a position of an optical element acting on light entering the optical microcantilever or on light exiting from the optical microcantilever.

25 11. An optical microcantilever employed in a scanning near field microscope, comprising:

a cantilever-shaped optical waveguide; and

a tip formed at the free end of the optical waveguide and having a microscopic aperture at an end thereof

wherein the optical waveguide comprises: a light input/output end at a fixed end thereof;

5 a nose section formed between the free end and the fixed end at an angle with respect to an optical axis of the optical waveguide of the fixed end; and

reflecting means for reflecting light propagating from the light input/output end in such a manner that the light is guided towards the nose section, and/or reflecting light detected by the microscopic aperture and transmitted to the nose section towards the light input/output end.

10 12. The optical microcantilever employed in a scanning near field microscope of claim 11, wherein

the optical waveguide has a head section at the end of the nose section extending substantially parallel with the optical waveguide of the fixed end, and  
15 the tip is formed at the head section.

13. The optical microcantilever employed in a scanning near field microscope of any one of claims 1 to 3, 11, and 12, wherein the optical microcantilever has a lens between the tip and the reflecting means.

14. The optical microcantilever employed in a scanning near field microscope of  
20 claim 13, wherein the lens of the optical microcantilever is a convex lens.

15. The optical microcantilever employed in a scanning near field microscope of claim 13, wherein the lens of the optical microcantilever is a Fresnel lens.

16. The optical microcantilever employed in a scanning near field microscope of claim 13, wherein the lens of the optical microcantilever is a gradient-index lens.

25 17. The optical microcantilever employed in a scanning near field microscope of any one of claims 1 to 3, and 11 to 16, wherein the tip of the optical

microcantilever is formed of a material having a higher refractive index than the optical waveguide.

18. An optical microcantilever employed in a scanning near field microscope, comprising:

5 a substrate;

a cantilever-shaped optical waveguide formed at the substrate;

a tip, having a microscopic aperture at an end thereof, formed at a side of the free end of the cantilever;

10 a light input/output end positioned at a side of the fixed end of the optical waveguide; and

an optical element guide, formed on the substrate on the side of the light input/output end, for deciding a position of an optical element acting on light entering the optical waveguide or on light exiting from the optical waveguide,

wherein the light input/output end projects above the optical element guide.

15 19. An optical microcantilever employed in a scanning near field microscope, comprising:

a substrate;

a cantilever-shaped optical waveguide formed at the substrate;

20 a light input/output end positioned at a side of the fixed end of the optical waveguide;

a tip provided at the side of the free end of the cantilever and having a microscopic aperture at an end thereof, and

light-blocking means for ensuring that light scattered by the light input/output end is not transmitted in the direction of the tip.

25 20. The optical microcantilever of claim 19, wherein at the optical microcantilever employed in a scanning near field microscope,

the light-blocking means is arranged above the substrate and the optical waveguide, and provides a wall for blocking the scattered light.

21. The optical microcantilever of claim 19, wherein at the optical microcantilever employed in a scanning near field microscope,

5 the light-blocking means comprises: a light-blocking agent located on the substrate and the optical waveguide; and

a light-blocking film located on the light-blocking agent,

and the light-blocking film is located in such a manner as to cover at least the light input/output end.

10 22. The optical microcantilever of claim 19, wherein at the optical microcantilever employed in a scanning near field microscope,

the light-blocking means comprises: a light-blocking film located on the substrate and the optical waveguide; and

15 a light-blocking agent arranged so as to cover at least part of an end of the light-blocking film,

and the light-blocking film is located in such a manner as to cover at least the light input/output end.

23. The optical microcantilever employed in a scanning near field microscope of claim 21 or claim 22, wherein the light-blocking film is movable.

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